Applicant: Wurz et al.
Application No.: 09/766,815

IN THE CLAIMS

Please amend claims 2, 16, 18, and 21, without prejudice or disclaimer, and add new claims 23-26. A complete listing of the claims of this application follow.

Claim 1 (Cancelled).

Claim 2 (Currently Amended): An apparatus for measuring an object on a conveyor having a width, the apparatus comprising:

a chassis;

a mirrored wheel rotatably located on the chassis;

a light source positioned on the chassis and oriented to transmit a light beam in a fixed direction onto the mirrored wheel, wherein when the wheel rotates the light beam is reflected while also being sequentially redirected at one of a plurality of varying angles resulting in the motion of the light beam, which is reflected from the mirrored wheel, defining a path oriented generally perpendicularly to the light beam;

a reflecting surface located on the chassis and oriented to receive the light beam that is reflected off of the mirrored wheel and to redirect the light beam toward the conveyor such that the path defined by the light beam extends generally across the width of the conveyor, wherein the light beam, when not obstructed by the object, impacts the conveyor at a nonzero angle relative to a perpendicular extending therefrom and defines a plurality of conveyor impact points, when the

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light beam impacts the object on the conveyor a plurality of object impact points are defined;

a detector disposed on the chassis and having a field of view initially oriented toward the mirrored wheel, wherein the field of view is redirected via the mirrored wheel and the reflecting surface to allow the detector to detect ~~a reflection~~ an impact of the light beam ~~off of~~ on one of the conveyor and the object at a plurality of locations as the light beam moves along the path across the conveyor; and

a processor, that is in communication with the detector, determines the measurements of the object and calculates the height of one edge of the object using the non zero angle and a distance between the plurality of object impact points located on the path on the one edge and the corresponding conveyor impact points located on a next adjacent path.

Claim 3 (Previously Added): The apparatus of claim 2 wherein the detector is fixed in an angularly offset position relative to the light source without the light beam departing from the field of view of the detector when the light beam reflects off of one of the conveyor and the object.

Claim 4 (Previously Added): The apparatus of claim 2 wherein the detector is a line scan camera that transmits a path-height-profile-measurement-signal which

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represents a height of the object, as measured at a plurality of locations along the path, relative to a conveyor surface.

Claim 5 (Previously Added): The apparatus of claim 4 further comprising a controller which receives the path-height-profile-measurement-signal as the object is transported across the path defined by a plurality of impact locations between the light beam and the conveyor surface.

Claim 6 (Previously Added): The apparatus of claim 5 wherein the path-height-profile-measurement-signal can be used to determine a height and a width of the object.

Claim 7 (Previously Added): The apparatus of claim 5 wherein a plurality of the path-height-profile-measurement-signals can be used to determine a height, a width, and a length of the object.

Claim 8 (Previously Added): The apparatus of claim 4 wherein:

the line scan camera has a lens and detector array; and

the lens and detector array are mounted in a fixed angular relationship with respect to each other and an image plane along the path, wherein the fixed angular

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relationship results in the line scan camera having a focus over a depth of field of at least about three hundred (300) millimeters.

Claim 9 (Previously Added): The apparatus of claim 8 wherein the depth of field is at least about nine hundred (900) millimeters.

Claim 10 (Previously Added): The apparatus of claim 2 wherein the detector is a position-sensitive detector that outputs a current representing a height of the object, relative to the conveyor, at the plurality of locations along the path.

Claim 11 (Previously Added): The apparatus of claim 10 further comprising a controller which receives the current from the position-sensitive detector as the object is transported across the path defined by a plurality of impact locations between the light beam and the conveyor.

Claim 12 (Previously Added): The apparatus of claim 10 wherein:

the position-sensitive detector has a lens and detector array; the lens and detector array are mounted in a fixed angular relationship with respect to each other and an image plane along the path, wherein the fixed angular relationship

results in the position-sensitive detector having a focus over a depth of field of at least about three hundred (300) millimeters.

Claim 13 (Previously Added): The apparatus of claim 12 wherein the depth of field is at least about nine hundred (900) millimeters.

Claim 14 (Previously Added): The apparatus of claim 2 wherein the reflecting surface has a parabolic shape.

Claim 15 (Previously Added): The apparatus of claim 2 wherein the reflecting surface comprises a multi-faceted parabolic surface.

Claim 16 (Currently Amended): A method of measuring an object on a conveyor, comprising:

emitting a single light beam in a fixed direction;

sequentially reflecting the light beam through a plurality of varying angles causing the motion of the reflected light beam to define a path generally perpendicular to the light beam, wherein the path extends generally across a width of the conveyor, wherein the light beam, when not obstructed by the object, impacts the conveyor at a

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nonzero angle relative to a perpendicular extending therefrom to define a plurality of conveyor impact points, when the light beam impacts the object a plurality of object impact points are defined;

detecting ~~the reflection~~ impacts of the reflected light beam ~~off of~~ on one of the object and the conveyor at a plurality of locations along the path; and

determining a height ~~profile~~ of one edge of the object, relative to the conveyor, ~~along the path~~ using the non zero angle and a distance between the plurality of object impact points along the one edge and the corresponding conveyor impact points located on a next adjacent path.

Claim 17 (Previously Added): The method of claim 16 wherein the step of sequentially reflecting the beam comprises reflecting the light beam such that the light beam repeatedly intercepts the object at an angle other than perpendicular from the conveyor surface.

Claim 18 (Currently Amended): A method for determining the dimensions of one or more objects on a conveyor, comprising the steps of:

directing at least one light beam onto the conveyor at a plurality of locations along ~~the~~ a path across a width of the conv yor;

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detecting ~~reflections~~ impacts caused by the at least one light beam striking one of the conveyor and the object, wherein the light beam, when not obstructed by the object, impacts the conveyor at a nonzero angle relative to a perpendicular therefrom to define a plurality of conveyor impact points, when the light beam impacts the object a plurality of object impact points are defined;

collecting time and location data associated with the detected ~~reflections~~ impacts; and

generating a height ~~profile~~ measurement of one edge of the object, relative to a conveyor surface, ~~along the path~~ using the non zero angle and a distance between the plurality of object impact points located on the path on the one edge and the corresponding conveyor impact points located on a next adjacent path.

Claim 19 (Previously Added): The method of claim 18 further comprising:

determining if the height-profile represents one or more objects; and

outputting a signal based on the number of objects identified by the height-profile.

Claim 20 (Previously Added): The method of claim 18 wherein the step of detecting reflections comprises using a charged coupled device to detect reflections.

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Claim 21 (Currently Amended): An apparatus for measuring an object on a conveyor having a width, the apparatus comprising:

at least one light source positioned above the conveyor and adapted to transmit a light beam that when not obstructed by the object, impacts the conveyor at a nonzero angle relative to a perpendicular extending therefrom to define a plurality of conveyor impact points ~~, wherein the light beam impacts the conveyor at a separate one of a plurality of locations~~ along a path extending across the width of the conveyor, when the light beam impacts the object to define a plurality of object impact points;

a detector disposed proximate to the conveyor and having a field of view, the field of view ~~, when not obstructed by the object, intersects the conveyor along the perpendicular~~, the field of view is adapted to allow the detector to detect a reflection of the light beam off of one of the conveyor and the object at the separate one of the plurality of locations; and

a processor, that is in communication with the detector, determines the measurements of the object and calculates the height of one edge of the object using the non zero angle and a distance between the plurality of object impact points located on the path on the one edge and the corresponding conveyor impact points located on a next adjacent path.

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Claim 22 (Previously Added): The apparatus of claim 21 further comprising:

a controller which receives a path-height-profile-measurement-signal as the object is transported across the path defined by a plurality of impact locations between the light beam and one of the conveyor surface and the object; and

wherein the detector is a line scan camera that transmits the path-height-profile-measurement-signal, which represents a height of the object, as measured at a plurality of locations along the path, relative to a conveyor surface; the controller being adapted to use the path-height-profile-measurement-signal to determine a height and a width of the object.

Claim 23 (Previously Added): The apparatus of claim 22 wherein a plurality of the path-height-profile-measurement-signals can be used to determine a height, a width, and a length of the object.

E2

Claim 24 (New): The apparatus of claim 1, wherein the field of view which intersects the conveyor remains centered about the perpendicular extending from the conveyor throughout the measuring of the object.

Claim 25 (New): The method of claim 16, wherein the step of detecting further comprises detecting impacts occurring within a detector field of view which

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intersects the conveyor and remains centered about the perpendicular extending from the conveyor throughout the measuring of the object.

Claim 26 (New): The method of claim 18, wherein the step of collecting further comprises detecting impacts occurring within a detector field of view which intersects the conveyor and remains centered about the perpendicular extending from the conveyor throughout the measuring of the object.

Claim 27 (New): The apparatus of claim 21, wherein the portion of the field of view which intersects one of the object and the conveyor remains centered about the perpendicular extending from the conveyor throughout the measuring of the object.